viral genes now being decoded, may help cancer researchers recreate the cancer message carried in certain viruses and may help them understand how this message is translated by host cells into uncontrolled and sometimes malignant tissue growth.

The team was able to map the genes by comparing normal and mutant forms of the sarcoma virus. The mutant form, which has lost the ability to transform normal cells into cancerous ones, has 15 percent less genetic material than the sarcoma form. The genes for oncogenesis, it turns out, are contained within this missing sequence. By a technique called oligonucleotide fingerprinting, the RNA molecules from both the sarcoma and mutant viruses were broken into fragments and the pieces analyzed. The fragments were then assigned to an order along the RNA molecule by the team's mapping techniques.

The team is presently attempting to isolate and map two other viral genes, one which controls the formation of the virus's inner protein coating and another which ultimately controls the production of new virus particles in the host cell. □

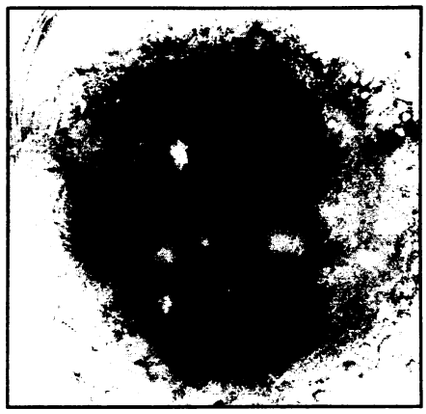
Bacteria: Metal beads and magnetism

Anton Mesmer, the notorious 18th-century Austrian physician and father of hypnosis, created from his readings in Greek astronomy and Renaissance medicine the theory that disease could be treated by restoring the body's proper balance of nervous fluids—fluids that, like the orbiting planets, are governed by magnetic fields. He turned this theory—"animal magnetism"—into what was even in the 18th century considered blatant medical quackery. He traveled Europe (often chased by local medical officials) sporting purple velvet robes and "healing" everything from melancholia to paralysis with his iron filings and magic wands.

A modern researcher, guided by fortuitous discovery rather than mystic theory, and using an electron microscope rather than a magic wand, has seen what could whimsically be called a modern instance of "animal magnetism." Or, better yet, bacterial magnetism. Richard Blakemore of the Woods Hole Oceanographic Institution reports in the Oct. 24 SCIENCE, finding bacteria that respond to magnetic forces by migrating toward the earth's magnetic north pole. And in a nearly mesmerizing show of life's creative adaptation, Blakemore's bacteria contain minute chains of iron beads that may orient the cells like living compass needles.

Blakemore calls this unique behavior "magnetotaxis," literally, movement oriented in response to magnetic force. Certain birds and marine animals are suspected of responding in some way to the earth's magnetic field, but these magnetotactic bacteria show the simplest, most direct response yet described. Blakemore discovered them while examining samples of marine mud from marshes near Cape Cod. He was attempting to isolate a certain type of bacterium under a light microscope when he noticed the tiny inhabitants of the mudpond beneath his cover slip repeatedly migrating toward the north. Indulging his curiosity with some simple tests, he eliminated light and oxygen as possible stimuli for the bacterial movement and settled on magnetic forces as an hypothesis.

Examination of the organisms under an electron microscope revealed small round



Adapted from Blakemore/Science

Iron-rich beads in marsh bacterium.

cells with two tufts of flagella and one or two chains of electron-dense particles held in tiny membranous pouches. Analysis revealed the particles to contain mostly iron, perhaps, Blakemore says, a permanently magnetic substance. Whether exposed to the earth's magnetic field or to an artificial one, the cells orient and then migrate toward the preferred pole.

Since his initial discovery, Blakemore has observed magnetotaxis in four more distinct types of bacteria. He has viewed only one of them with electron microscopy, but it, like the first, contained the iron-rich beads. The bead chains may well have a relationship to cell orientation in magnetic fields, but this is still hypothetical. The relationship of the chains to taxis is still more hypothetical, Blakemore says, but there may be a fixed spatial relationship between the particles and cell propulsion. This, however, remains to be proved through future experimentation.

Probably the most intriguing question, at least for the armchair evolutionist, is what role does magnetotaxis play in the adaptation of these bacteria to their marsh mud niches? It might help direct the bacteria downward, Blakemore speculates, toward richer, less aerated sediments, and thus aid survival. "But the safest speculation I can really make at this point," he says, "is that if there is a selective advantage to magnetotaxis, it should be testable. And that's just what I plan to do." □

Imperatives for the new agriculture

Recent advances in genetic engineering and cell-culture techniques have given agricultural scientists a new opportunity to increase crop productivity and quality, while tailoring plants to meet the specific needs of a particular location (SN: 10/5/74, p. 218). Some 200 leading scientists from a half dozen fields met last week at a remote resort near Harbor Springs, Mich., to draw up a list of research imperatives to guide funding agencies as they encourage application of the new discoveries. One of the conference organizers, Sylvan Wittwer, director of the Michigan State University Agricultural Experiment Station, says that a funding increase of as much as 40 percent could now be profitably absorbed.

The list of imperatives reads like a what's what in recent biological advances: application of genetic engineering to improve nitrogen fixation in various bacteria species, introduction of new plant-growth regulators into major crops to alter maturation characteristics, and use of cell-culture manipulation to create new "broad crosses" incorporating the best features of two different crop species. But the recommendations, which will be published early next year, also point out some disturbing gaps in knowledge about fundamental processes. The key word that emerged time and again was "regulation." Although scientists have long recognized the intricate steps by which plants grow, demonstrate photosynthesis and reproduce, the genetic and hormonal controls of many processes are unknown.

Fundamental research in many of these areas has been "grossly neglected on a global scale," Wittwer says, but now "agriculture is being discovered by some very important people." Not surprisingly, as the discipline becomes more glamorous, more people want to get into the act. One professor told SCIENCE NEWS that many of his new students are from big cities and "would never have considered going into agriculture before." Another complained aloud to the conference that now, after the National Institutes of Health had sponsored much of the key basic research through university grants, the Department of Agriculture is exercising its territorial prerogatives and wants to place more of the work into its own staff-run laboratories.

As clumsy as the World Food Conference seemed at the time (SN: 11/30/74, p. 349), governments around the world have apparently given new priority to crop productivity, including related fundamental research. William Furtick of the UN Food and Agricultural Organization told the conference that within three years after the Rome meeting resources devoted to global agriculture will have tripled. □